CLAIMS

What is claimed is:

1. A sensor employing a mechanical resonator, comprising:

a resonator portion for resonating in a fluid; and

an electrical connection between the resonator portion and a source of an input signal, including at least one electrode that is at least partially covered by a dielectric material;

wherein the resonator portion, the electrical connection or both includes a base material and a performance-tuning material that is different from the base material, is relatively hydrophobic, and exhibits a porosity of less than about 5% of its volume.

2. A sensor according to claim 1, wherein the resonator portion includes at least one tine.

3. A sensor according to claim 2, wherein the resonator portion includes at least two tines for defining a tuning fork.

4. A sensor according to claim 1, wherein the resonator portion includes at least two tines for defining a tuning fork and the tines are joined together at a cross member to define a generally "H" shaped structure.

5. A sensor according to claim 3, wherein the base material of the resonator portion includes a piezoelectric material, an electrostrictive material, a magnetostrictive material, a piezoresistive material, an elasto-optic material, an anisotropic material, or combinations thereof and the electrical connection includes at least one electrode formed of a metal selected from gold, platinum, silver, chromium, aluminum, nickel, titanium or mixtures thereof.

6. A sensor according to claim 5, wherein the base material of the resonator portion includes quartz, lithium niobate, zinc oxide, lead zirconate titanate (PZT), gallo-germanates, diomignite (lithium tetraborate), bismuth germanium oxide gallium phosphate, gallium nitride, aluminum nitride or combinations thereof.

7. A sensor according to claim 5, wherein the performance-tuning material includes polymers, ceramics, metals, metal carbides or nitrides, diamond, diamond-like carbon, and combinations thereof.

8. A sensor according to claim 6, wherein the performance-tuning material includes polymers, ceramics, metals, metal carbides or nitrides, diamond, diamond-like carbon, and combinations thereof.

9. A sensor according to claim 7, wherein the performance tuning material includes a layer partially overlying a base resonator material; includes a layer entirely overlying a base resonator material; is an intermediate layer in the resonator; is dispersed within the base material; or combinations thereof.

10. A sensor employing a mechanical resonator, comprising:

a resonator portion including at least two tines adapted for resonating in a fluid; and

an electrical connection including at least one electrode formed of a metal selected from gold, platinum, silver, chromium, aluminum, nickel, titanium or mixtures thereof between the resonator portion and a source of an input signal,

wherein the resonator portion includes:

a doped or undoped base material that exhibits a dielectric constant that is substantially constant over a temperature range of at least about O ^{o}C to about 100^{o}C, and is selected from the group consisting of quartz, lithium niobate, zinc oxide, lead zirconate titanate (PZT), gallo-germanates (e.g., Langasite ($La_3Ga_5SiO_{14}$), Langanite, or Langatate), diomignite (lithium tetraborate), bismuth germanium oxide gallium phosphate, gallium nitride, aluminum nitride or combinations thereof; and

a performance-tuning material that is relatively hydrophobic, exhibits a porosity of less than about 5% of its volume, is stable at about 150°C, is different from the base material and is selected from the group consisting of polymers, ceramics, metals, metal carbides or nitrides, diamond, diamond-like carbon, and combinations thereof.

11. The sensor according to claim 10, wherein the at least one electrode is at least partially covered by a dielectric material.

12. The sensor according to claim 11, wherein the base material is quartz.

13. The sensor according to claim 10, wherein the base material is lithium niobate.

14. The sensor according to claim 10, wherein the base material is PZT.

15. The sensor according to claim 10, wherein the base material is a gallo-germanate.

16. The sensor according to claim 10, wherein the performance-tuning material includes one or a combination of two or more materials selected from the group consisting of fluoropolymers, silicones, silanes, polyolefins, carbides, nitrides, oxides, diamond, diamond-like carbon, and combinations thereof.

17. The sensor according to claim 10, wherein the performance-tuning material includes one or a combination of two or more materials selected from the group consisting of polytetrafluoroethylene, fluorosilicone, polyethylene, polypropylene, silicon carbide, silicon nitride, diamond, diamond-like carbon, and combinations thereof.

18. The sensor according to claim 6, wherein the performance-tuning material includes one or a combination of two or more materials selected from the group consisting of polytetrafluoroethylene, fluorosilicone, polyethylene, polypropylene, silicon carbide, silicon nitride, diamond, diamond-like carbon, and combinations thereof.

19. The sensor according to claim 10, wherein the performance-tuning material includes a fluoropolymer.

20. The sensor according to claim 10, wherein the performance-tuning material includes a ceramic.

21. The sensor according to claim 10, wherein the performance-tuning material includes a metal nitride.

22. The sensor according to claim 10, wherein the resonator portion formed from a wafer.

23. The sensor according to claim 11, wherein the performance-tuning material is employed as a layer that is continuous or intermittent, along edges of the resonator base material, within the interior of the resonator base material, or a combination thereof.

24. A method for making a resonator, comprising:

a) forming a plurality of resonators on a common substrate; the resonators including:

a resonator portion adapted for resonating in a fluid; and

an electrical connection including at least one electrode formed of a metal selected from gold, platinum, silver, chromium, aluminum, nickel, titanium or mixtures thereof between the resonator portion and a source of an input signal,

wherein the resonator portion includes:

a doped or undoped base material that exhibits a dielectric constant that is substantially constant over a temperature range of at least about O °C to about 100°C, and is selected from quartz, lithium niobate, zinc oxide, lead zirconate titanate (PZT), gallo-germanates, diomignite (lithium tetraborate), bismuth germanium oxide gallium phosphate, gallium nitride, aluminum nitride or combinations thereof; and

a performance-tuning material that is different from the base material and is selected from the group consisting of polymers, ceramics, metals, metal carbides or nitrides, diamond, diamond-like carbon, and combinations thereof; and

b) separating the resonators from each other.

25. The method according to claim 26, further comprising:

c) at least partially covering at least one electrode with a dielectric.

26. The method according to claim 27, wherein the performance tuning material is resistant to absorption of oils.

27. A method for making a tuning fork resonator, comprising the steps of:

providing a base material of a tuning fork resonator selected from quartz, lithium niobate, zinc oxide, lead zirconate titanate (PZT), gallo-germanates, diomignite (lithium tetraborate), bismuth germanium oxide gallium phosphate, gallium nitride, aluminum nitride or combinations thereof;

coating the base material with a performance tuning material selected from the group consisting of fluoropolymers, silicones, silanes, polyolefins, carbides, nitrides, oxides, diamond, diamond-like carbon, and combinations thereof.

28. The method of claim 27, wherein the performance tuning material is stable at about 150°C, and is resistant to absorption of oils.